Piercing the veil

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A vertical oil curtain is excited by an orthogonal flow of air. In a first step, the flow is asymmetrical and the air is injected at 10 Hz. Varying the air flow strength and the oil flow-rate, several regimes are encountered and a phase diagram has been pictured. The curtain may remain undamaged by the air pulses. When the strength is increased or if the oil flow is decreased, a hole may be generated and directly self-healed. Finally, for even higher air flow and even lower oil flow, the curtain may break up. Among the 'no-hole' states, a periodic ejection of oil droplets is observed and even oil bubbles are formed. In a second step, the air flow is injected in a symmetrical way from each side of the oil curtain. The oil film is then locally squeezed. A stable hole may be generated downstream. It remains at a constant distance from the air injection point. This distance may be changed by increasing the oil flow rate, resulting from a balance between the capillary forces (pulling upstream) and the convective flow (pushing downstream).

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